INVESTIGATION OF ANTIOXIDANT CAPACITY OF BROWN CAPPED BUTTON MUSHROOM CANDIDATE VARIETIES

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Abstract
The button mushroom (*Agaricus bisporus*) is one of the most widely cultivated mushrooms in the world thanks to its high endogen components. Ingredients of the mushroom with ferric reducing capacity in brown button mushroom can stop or delay the effects of oxidative damage, therefore they play an important role in maintaining health care. During the research process, was used the activity of enzymes participating in antioxidant defense (peroxidase, polyphenol oxidase) and polyphenol content known from non-enzyme defense to describe the reducing properties of brown capped button mushroom candidate varieties, along with the FRAP method based on ferric reducing capacity. Our goal is to compare the number of bioactive substances and substances with significant reducing capacity based on the examined parameters of the button mushroom candidate varieties and, based on the compounds with significant reducing properties to identify the best candidate varieties. According to our results it can be concluded, that there is a strong connection between the measured parameters and the individual candidate varieties, based on which we can choose the candidate variety deemed best.

Introduction

Consuming harvested mushrooms, due to their valuable high endogenous compound content, contributes to proper nutrition and health protection. Mushrooms contain vitamins, vitamin precursors, minerals, trace elements and additionally endogenous materials with specific antioxidant effects, primarily compounds containing phenol [1].
The most widely cultivated mushroom within Europe is *Agaricus bisporus*, which can be found in nature but cultivation technology also highly commercialized. Similar to fruits and vegetables, mushrooms contain valuable substances that play a role in the defense against free radicals and maintaining human health. It is known that an increased number of free radicals can be linked to several diseases [2]. Different enzymes and valuable consumed endogenous components play a role in defense against these free radicals [3, 4]. There have been multiple findings of strong antioxidant effect in the extract of several mushroom varieties, proving that for example, the polyphenols in them have a positive physiological effect [5].
In contrast with crops harvested for hundreds if not thousands of years, during the cultivation of mushrooms, the lack of knowledge about the biology and growing technique of harvested mushrooms is a big challenge. The physiological properties of harvested mushrooms are affected by environmental stresses, therefore the knowledge of their sections of the defense system is crucial. The differences in the activity levels of the peroxidase and polyphenol oxidase enzymes are a great indicator of the different responses given to the reaction to stresses [6] and are an excellent tool to describe resistance [7].
Mushroom reacts to oxidative stresses by preventive and neutralizing activities, which are partially based on the difference between the levels of activity of the enzymes. The examination of endogenous reducing compounds is a proper way of describing the stress-sensitivity and health-protective effect of mushrooms [8, 9].

Materials and methods

The chemicals used during the examination were acquired from Sigma-Aldrich.

The mushroom samples (button mushroom – *Agaricus bisporus*) were cultivated at the Department of Vegetable and Mushroom Growing, Szent István University. The mushrooms were cultivated using the same substrate and cultivation technology, therefore their biophysical parameters are linked with their genetical background. They examined 7 candidate varieties mushrooms were coded B1-B7 and were triturated in a mortar while fresh, with a known amount of extractor, then they were centrifuged and the clear supernatant was stored at -32° C until measurements.

Peroxidase (POD) and polyphenol oxidase (PFO) enzyme activities were measured spectrophotometric method of Shannon [10] and of Flurkey [11] and at λ = 460 nm and at λ = 420 nm. The results were given in U/100 g (POD) and U/g (PFO) with respect to dry matter.

Total polyphenol content (TPC) was determined by the method of Singleton and Rossi [12] with Folin-Ciocalteu reagent. Color change during the reaction was detected by a spectrophotometric method (λ=760 nm). The results were expressed in gallic acid equivalent (mM GAE/g dry matter).

The total antioxidant capacity of the different extracts was measured by the FRAP method of Benzie and Strain [13]. The reaction causes a blue color change, which can be detected spectrophotometrically at λ=593 nm. The results were expressed in ascorbic acid equivalent (µM AAE/g dry matter).

Results and discussion

The measured enzyme activities in the stipes and caps were different (Figure 1.). The polyphenol oxidase enzyme activity is higher in the stipes in the majority of the cases. The opposite is also true in the case of peroxidase enzyme activity measurements, where the values are higher in the cap of the examined mushrooms. The candidate variety marked B6 showed extraordinarily high values, so presumably, this variety has the most peroxidase and polyphenol oxidase enzyme activity which points to the mushroom's better readiness to stress. The polyphenol oxidase enzyme activity is far greater than that of the peroxidase enzyme activity. The result supports the theory of high polyphenol compound levels in mushrooms.

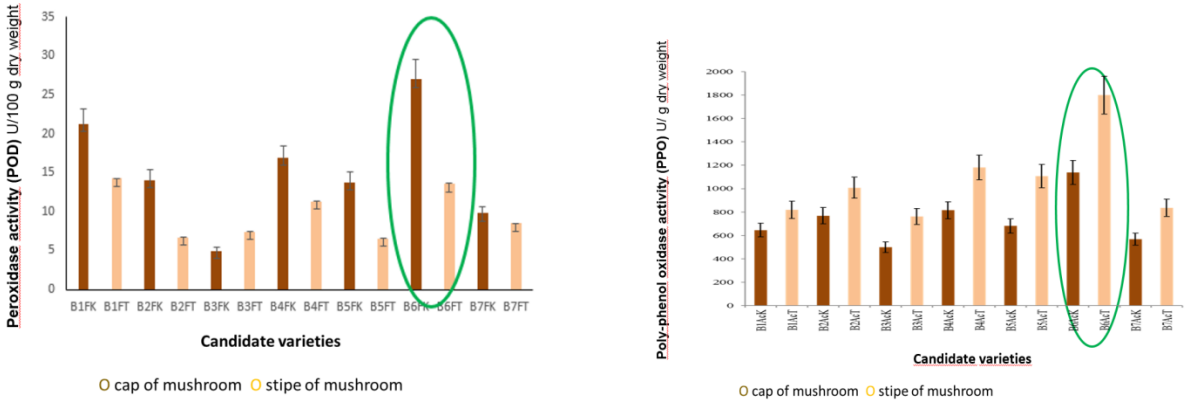

Figure 1. Peroxidase (POD) and Polyphenol oxidase (PFO) enzyme activity of the mushrooms

The total polyphenol content and the antioxidant capacity measurements were made on the separated stipe and cap of the mushroom. Comparing the polyphenol content and antioxidant capacity measured in the cap and stipe of the button mushroom, similar to the previous findings, the values were higher in the cap than in the stipe (Figure 2.). The majority of materials with reducing properties in mushrooms are made of polyphenol-like ingredients, this is supported by the similarity between the illustrations displaying polyphenol content and

antioxidant capacity. Presumably, the differences with candidate variety B6 are caused by another polyphenol based component. The similarity between the diagram displaying the total polyphenol oxidase content and the pictures displaying the number of materials with polyphenol-like properties is proof of the relationship between polyphenol and the enzyme breaking it down. In all cases, especially with candidate variety B6, the accumulated polyphenol content serves the protection of a more resistant candidate variety.

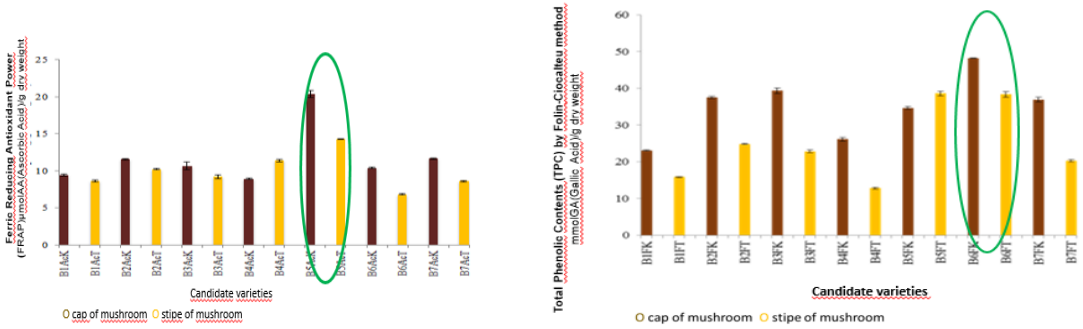

Figure 2. Total polyphenol content (TPC) and Ferric reducing antioxidant capacity (FRAP) of the mushrooms

Conclusion

During the research done on brown button mushroom candidate varieties, comparing antioxidant capacity and total polyphenol content, it can be concluded that polyphenol-based molecules are responsible for the majority of compounds with an antioxidant effect in mushrooms. There are significant differences in the amount of endogenous components measured in the caps and stipes of the different candidate varieties. Based on my research it can be concluded that the components we measured can be isolated, based on which it is possible to choose the candidate variety with the most appealing properties, in this case, candidate variety B6, however, these measurements should, of course, be supported by measuring methods valuable for harvest.

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